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State of Connecticut

State Geological and Natural History Survey

BULLETIN NO. 7

GEOLOGICAL SURVEY
WASHINGTON, D. C.

PRELIMINARY GEOLOGICAL MAP OF CONNECTICUT

By

HERBERT ERNEST GREGORY, Ph.D.,
Professor of Geology in Yale University

AND

HENRY HOLLISTER ROBINSON, C. E., Ph.D.,
Instructor in Geology in Yale University

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C. WILLARD HAYES,
U. S. Geological Survey,
WASHINGTON, D. C.

State of Connecticut

PUBLIC DOCUMENT No. 47

State Geological and Natural History Survey

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BULLETIN No. 7

HARTFORD PRESS
The Case, Lockwood & Brainard Company
1907

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PREFACE.

The small scale used for the Preliminary Geological Map of Connecticut makes it impracticable to represent all the rock groups, and to give credit on the map itself to the individuals and organizations whose assistance has made the map possible. The following pages have therefore been written to make the map more intelligible, and to explain its method of compilation, its value, and its deficiencies. This Bulletin has also been thought to be a suitable place to present a brief account of the history of geologic work in Connecticut. The imperfection of the map herewith presented is manifest, and the authors will be thankful for any information which will tend to make the knowledge of Connecticut geology more complete and more accessible.

HERBERT ERNEST GREGORY,
HENRY HOLLISTER ROBINSON.

New Haven, Conn., Dec. 23, 1906.

PRELIMINARY GEOLOGICAL MAP OF CONNECTICUT.

OUTLINE OF THE GEOLOGY OF CONNECTICUT.

A glance at the Connecticut geologic map which forms part of this Bulletin reveals the fact that the state consists of three geologic provinces: viz., a western portion composed of metamorphic crystalline rocks, an eastern portion of like character, and a central portion of sandstones and lavas. Topographically these areas constitute the Western Highland, the Eastern Highland, and the Connecticut and Farmington Valley Lowland. The rocks forming the Highlands are gneisses, schists, quartzites, and limestones of very great age, with intrusions of granitic, pegmatitic, and basic material. The characteristic structures present are the results of extreme metamorphism, and have been revealed by erosion of unknown thousands of feet of overlying rock. The sandstone, basalt, and diabase of the Lowland and of the small Pomperaug Valley area are of Triassic age, and rest uncomformably upon the underlying crystalline rocks.

Land doubtless existed in Connecticut before the earliest fossiliferous rocks were deposited, but the nature of such land areas is unknown. Whether originally igneous or sedimentary, or both, is undetermined; all that is certain regarding a pre-Cambrian formation like the Becket gneiss is that its present structure and composition are the results of a long series of changes which have completely altered the original rock mass. During Cambrian and Ordovician time, sandstone, shale, and limestone were being deposited in western Connecticut, forming the originals from which the Poughquag quartzite, Berkshire schist, and Stockbridge

limestone were later developed. The history of Connecticut during Silurian, Devonian, and Carboniferous time has not been deciphered. It is evident, however, that important and wide-spread disturbances occurred prior to Triassic time, and that injection and regional metamorphism have been important factors in the formation of the crystallines. As a result of these two processes, the rocks of the Highlands have been rendered crystalline, have been stretched and squeezed and drawn out into lines, and have suffered intrusion of granitic masses and dikes, pegmatite veins, masses and dikes of gabbro, amphibolite, etc. The rocks have, accordingly, in many cases, been so modified that their original character is destroyed. Fossils, which they may have contained, have been destroyed, and with them the means of determining the age of the rocks.

During Triassic time sandstones and shales were deposited over parts of Connecticut, and exist now in two areas shown on the map. The deposition of Triassic sediments was interrupted by at least three separate periods of volcanic activity, which produced the diabase and basalt from which have been carved the trap ridges that form such conspicuous features of the topography of central Connecticut. The lavas and sandstones were at a later date broken into blocks which were tilted toward the southeast.

The last great epoch in the geologic history of Connecticut was the Glacial age. Ice sheets covered the entire state; and in their advance southward the glaciers scoured and grooved the rock, reduced irregularities of topography, and carried much of the surface covering beyond the borders of the state. When the ice retreated, masses of loosened rock waste were left unevenly distributed over the state as gravel, hard-pan, bowlders, etc.

On the geological map no account is taken of the presence of Glacial material, but the state is divided into rock formations as they are thought to exist beneath the surface covering.

A fuller treatment of the Geology of Connecticut will be found in Bulletin No. 6.

SKETCH OF THE HISTORY OF CONNECTICUT GEOLOGY

The geology of Connecticut has attracted the attention of scientific men for nearly a century, and the first geologic map issued in this country distinguishes the Triassic sandstones from the crystallines. From the time when the first paper on the Mineralogy of the Town of New Haven was published by Silliman, in 1810, valuable contributions to the geology of the state have been made by state and national surveys and by private individuals.

CONNECTICUT GEOLOGICAL SURVEYS.

The teaching of Benjamin Silliman at Yale (1804-1853), and the founding of the *American Journal of Science,* in 1818, served to arouse great interest in the study of natural history in America. This interest expressed itself in provision for geological instruction in the colleges, and in the investigation of the natural resources of the various states by commissions appointed by the legislatures. North Carolina took the lead and established a survey in 1823. South Carolina appointed Professor Vanuxem State Geologist the following year. In 1830 Edward Hitchcock was appointed State Geologist of Massachusetts, and two reports were issued, in 1832 and 1833, respectively. Tennessee established a survey in 1831, New Jersey and Virginia in 1835, Maine, New York, and Pennsylvania in 1836, Kentucky in 1838, New Hampshire and Rhode Island in 1839. The first geological survey of Connecticut was established in 1835.

The Percival Survey.— The credit for the establishment of the first Geological Survey of Connecticut belongs to

Governor Edwards, who, after consultation with Silliman, Percival, and others, brought the matter before the legislature, urged action, and afterwards exerted his influence in favor of allowing geologists adequate time and means for prosecuting the work. In his annual message for 1835, Governor Edwards says:—

"The mineralogical treasures which have been developed within a few years and which are constantly coming to light in different parts of our country, give us reason to believe that we have not as yet availed ourselves to the extent that we might of this source of wealth, and suggests the expediency of a more systematic examination than has hitherto taken place. In some instances this has been done under the public patronage, and by public authority. An examination of the kind in our State might lead to some important discoveries. An accurate and thorough geological and mineralogical survey by scientific men, if it should not result in any immediate discoveries of moment, would at least have the effect of aiding individuals in their future researches on their own lands. Much labor has been expended, and money wasted, in the search after metals and minerals, which a knowledge of those substances and the relative position they uniformly occupy, would have shown to be useless.

"The geological character of a country indicates its topographical features; and a geological map would serve as a guide in the examination and selection of routes for railroads, and canals, and internal improvements of every kind, the location of which depends on the topical features of the country through which they pass. A survey of the kind referred to, would furnish every individual with such information respecting his possessions, as would guard him against the wiles of prowling speculators. Much labor has been bestowed on this subject, and much information collected by individuals in different sections of the state, and it is important that this information should be embodied and preserved; the expense would be trifling, and bear but a very small proportion to the benefits which may be derived

from it. This is a subject in which the whole community has a deep interest, and it is recommended that immediate measures be taken for its accomplishment. Similar surveys have been already had in some of the states; and the attention of others is turned to the subject. Let us not be deficient on our part; we have heretofore furnished, and we can still furnish, our full quota to those economical and scientific researches which seem to be the order of the day."

In accordance with the above recommendation, the legislature passed the following resolution: —

"Resolved, That the Governor be and is hereby authorized to appoint a committee of suitable persons to make a geological survey of the state of Connecticut, and to report the same to the General Assembly at their May Session of 1836.

"Resolved, That the property of such survey shall be in and belong to the State, and shall be disposed of as the General Assembly may direct."

The charge of the survey was offered to Silliman, who refused it, as did also Percival, and later Shepard. Finally, at the urgent request of Governor Edwards and of Shepard, it was arranged that Percival should undertake the study of the general geology of the state, and Shepard the study of the mineralogy and economic geology. These two men accordingly took up the work under the following official appointment: —

"Henry W. Edwards, Governor of the State of Connecticut, to James Gates Percival and Charles Upham Shepard,— greeting: Pursuant to resolves passed by the General Assembly of Connecticut, at Hartford, in May, 1835, I do appoint you, said Percival and Shepard, a committee to make and complete the survey and report in said resolves, to perform the duties thereof, and obey the instructions from time to time received from the proper authority.

"Given under my hand and official seal, at New Haven, this 15th day of June, A. D. 1835.

HENRY W. EDWARDS."

The reports of Percival and Shepard were accepted by the legislature of 1836, and the Survey was continued for another year. The work assigned to Shepard was largely a matter of collecting and classifying, and after some six months' work that officer handed in "A Report on the Geological Survey of Connecticut," dated May 15, 1837. The committee to which Shepard's work was referred recommended its publication in the following report:—

"The joint committee on the Geological and Mineralogical Survey of the State, to whom was referred the Special Message of the Governor and the accompanying papers relating to the mineralogical department of said survey, having had the same under their consideration, Report,

"That Professor Shepard has brought his examination into the mineralogy of the State to a close, and the results of his labors have been before us in a highly interesting and valuable Report. This Report, embracing the statistics of all our present mineral resources, the condition of our mines, quarries, and diggings of every description, and suggestions as to the most profitable manner of working them both to the proprietors and the public, all of which are capable of immediate application,— your committee recommend should be immediately published. * * * *

"The document will constitute an 8vo volume, or pamphlet, of one hundred and fifty pages; and, if published in the style in which these surveys are done in other states, will cost about twenty-five cents a copy. Your committee, therefore, recommend an appropriation of a sum of money not exceeding five hundred dollars, or such less sum as his Excellency the Governor may contract for, for the publication of two thousand copies. That, of this number, the Governor be authorized to distribute copies in the following manner:—

"Two copies to the library of Congress; two copies to the Governor of every state in the Union; two copies to the library of Yale College, of Washington College, and of the Wesleyan University of this state,— and to each of the State Officers; one copy to each of the Judges of the

Supreme Court; one copy to each of the Judges of the County Court and to each Probate Judge of this State, who are not members of this Legislature; one copy to each member of the two Houses of the present Legislature; one copy to the town clerk of every town in the State; fifty copies to remain at the disposal of Prof. Shepard, and the same number at the disposal of his Excellency, the Governor."

The resolution as finally passed by the legislature is as follows:

"Resolved by this Assembly, That two thousand copies of Prof. Shepard's Report on the Mineralogy of the State be published under the superintendence of the author, and that a sum of money not exceeding five hundred dollars be appropriated to defray the expenses,—and that the Comptroller of public accounts is hereby authorized to draw an order on the Treasurer for such sum, not exceeding five hundred dollars, to be paid out of any money not otherwise appropriated,—and his Excellency, the Governor, is hereby appointed Commissioner to see the object of this resolution effected."

The report was issued the same year.

The task which Percival had undertaken could not be thus easily disposed of. It involved a determination of rock types with their endless variation, a careful tabulation of dips and strikes, and the preparation of a detailed geological map of an unknown region. Percival worked at his task year after year, while the legislature, and especially Governor Ellsworth, became more and more impatient. The Governor and Percival were evidently working at cross purposes; the former wanted information regarding the supposed mineral wealth of the state, while Percival had set out to solve the problems relating to the composition and complicated structure of the rocks. In the spring of 1838 he presented an exhaustive report,* but was unwilling to have it published until he had verified his statements by an examination of his newly collected material.

* No trace of this manuscript has been found

Work was continued during 1838, 1839, 1840, and 1841; and during this time the misunderstanding with the state authorities became more acute. Finally the small state appropriation was cut off, and Percival, seeing that time was not to be allowed for a careful study of his material, decided reluctantly to prepare such a report as the circumstances would allow.

The "Report on the Geology of the State of Connecticut; by James G. Percival," was written in the spring of 1842; in May an appropriation of $1,500 was made for printing one thousand copies, and the book appeared before the close of the year. In the preface the author remarks:—

"The report which follows is but a hasty outline, written mainly from recollection, with only occasional reference to my materials, and under circumstances little calculated for cool consideration. It was written, however, with an intention to state nothing of the truth or probability of which I did not feel satisfied. None can regret more than I do, its imperfection; * * *"

Percival had devoted more than five years of his life to this work, and had received on the average $600 per year, out of which all expenses had to be paid. Under these circumstances, it is not creditable to Governor Ellsworth's administration that another year's appropriation was refused, and the State Geologist thereby forced to write his report without proper use of his voluminous notes and extensive collections.

The method of conducting the geological survey is explained by Percival in the preface to his report:—

"During the summer of that year [1835], I travelled, with Prof. Shepard, through every town in the State, but the short period then allowed me, only enabled me to make a general preparatory reconnoissance. An additional appropriation for the continuance of the survey, was made by the Legislature, in the session of 1836. I then commenced, by myself, a regular plan of survey, by sections across the State, from East to West, at average intervals of four miles. This I accomplished in nearly eight months

constant travel. In the session of 1837, a further appropriation was made to enable me to complete the survey, after having prepared a report of my previous explorations. This report I completed and submitted, Jan. 1st, 1838. Before commencing a re-survey of the State, I undertook an exploration of the Trap dikes traversing the Primary, which I traced throughout their whole extent. Before engaging in the survey (in 1834), I had particularly explored the different ranges of Trap connected with the two Secondary formations in the State, and had traced them out so fully, that only two or three unimportant localities have since occurred to me. After I had completed my examination of the Trap dikes in the Primary, I commenced a resurvey of the State, by sections from East to West, as before, in the intervals between my former sections, thus reducing the average distance of my sections to two miles, and bringing myself in contact with each of the 4,600 square miles in the State. This does not include my general reconnoissance the first season, nor my particular exploration of the Trap connected both with the Secondary and Primary. In my first regular survey, I had ascertained the general system of arrangement in the rocks of the State, and had prepared myself for a more discriminating investigation of the different formations. The second survey I consequently made more minutely, and devoted to it a much greater length of time. In these two surveys I had taken ample notes, in which I had marked the character and relative arrangement of the rocks in the different localities examined, as well as the direction and dip of the strata in each. I had also collected illustrative specimens in most of the localities, all of which are so arranged and labelled, that the precise locality and relation of each can, by reference to my notes, be at once determined. The number of localities from which I have collected specimens, I have estimated at nearly 8000; the records of dips and bearings are still more numerous."

Percival's Report on the Geology of Connecticut is not a readable book; it does not contain theories and inferences and bits of lively description, but merely dry facts grouped

geographically. It is about the last book which a poet, one of the most celebrated of his time, would be expected to write. Accuracy and keenness of observation and distinctness of representation are, however, prime requisites for lasting scientific work, and in these qualities Percival excelled. The more the modern geologist becomes familiar with the involved structures and exasperating variations found within the metamorphic rocks of the state, the more respect and admiration he has for Percival's discrimination and skill in delineation. It is doubtful if ever a more accurate discrimination of the various members of a complicated series of crystalline rocks on field evidence alone was ever accomplished.

The Connecticut Topographical Survey.— The preparation of a satisfactory base map of Connecticut was not undertaken until the attention of the legislature was called to the need of such a map by Governor Bulkeley, in 1889. In his message for that year the Governor says:—

"My attention has been called to the fact that the state has never secured an official and accurate topographical survey and map of the state, and that a favorable opportunity now exists through the co-operation of the general government, to secure such a survey and map at a moderate expense. You will be asked to give this subject your serious consideration. Adjoining states have taken advantage of the work of the United States Geological Survey, and in Massachusetts and Rhode Island the field work of the surveys is completed. The desirability of securing an accurate map of the state cannot, I think, for a moment, be doubted."

The following resolution for the establishment of a topographic survey originated with Judge S. W. Adams of Hartford, was passed by the legislature, and was approved early in June, 1889:—

"Resolved by this Assembly: That the Governor be and he is hereby authorized to appoint a Commission, to consist of three citizens of this State, qualified by education and experience in topographical science, to confer with the di-

rector or representative of the United States Geological Survey, and to accept its co-operation with this State in the preparation and completion of a contour topographical survey and map of this State, which is hereby authorized to be made, and it is hereby provided that said map shall accurately show all town and county boundary lines in this State as existing at the time of its completion. Said commission shall serve without pay, but all its necessary expenses shall be approved by the comptroller, and paid out of the State treasury. Said commission shall have power to arrange with the director or representative of the United States Geological Survey concerning the survey and map herein provided, for its scale, method of execution, form, and all details of the work, in behalf of this State, and may accept or reject the work presented by the United States Geological Survey. Said commission may expend, in the prosecution of this work, a sum equal to that which shall be expended therein by the United States Geological Survey, but the total cost of this survey to this state shall not exceed the sum of twenty-five thousand dollars."

On June 12th there was appropriated "for a Topographical Survey of the State of Connecticut, $25,000, provided said survey together with all costs for labor and expenses of the commission appointed therefor and all other expenses connected therewith can be completed for that sum."*

On June 19th, 1889, William H. Brewer of New Haven, James H. Chapin of Meriden, and John W. Bacon of Danbury, were appointed Commissioners of the State Topographical Survey.

In July, 1889, work on the state map was actively begun under the following contract:—

"Agreement between the Commissioners of the State of Connecticut and the Director of the United States Geological Survey, for the construction of a Topographical Map of Connecticut:

"1. The preparation of the map shall be placed under the supervision of the director of the United States Geolog-

* The amount actually expended was $24,597.21.

ical Survey, who shall determine the methods of survey and map construction.

"2. The work shall be based upon the triangulation of the United States Coast and Geodetic Survey, and wherever this is deficient it shall be supplemented by the United States Geological Survey.

"3. The survey shall be executed in a manner sufficiently elaborate to prepare a map upon a scale of 1:62,500, exhibiting the hydrography, hypsography, and public culture, and including all town and county boundary lines in this state as established at the time of its completion, and the preliminary field maps shall be on such a scale as the director of the United States Geological Survey may select to secure accuracy in the construction of the final map.

"4. The hypsography shall be shown by contour lines with vertical intervals of 20 ft.

"5. The heights of important points, including dams, shall be determined and furnished to the Commissioners of Connecticut.

"6. The outlines of wood areas shall be represented upon proofs of the engraved map to be furnished the Commissioners of Connecticut. * * *

"9. The resulting map shall fully recognize the cooperation of the State of Connecticut.

"10. When the work is completed the Commissioners of Connecticut shall be furnished by the United States Geological Survey with photographic copies of the manuscript sheets; and when the engraving is complete said commissioners shall be furnished by the said Survey with electrocopper plates of the sheets of the map, without cost to the State in excess of the twenty-five thousand (25,000) dollars appropriated by the State, less the necessary expenses of the State Commission."

By a subsequent agreement country houses were indicated on the map, an undertaking not heretofore attempted by the Geological Survey.

When the Government field parties began work in Connecticut, they made use of the previously established signal stations of the United States Coast and Geodetic Survey;

for example, Mount Carmel, Ivy Mountain, Bolton Mountain. This triangulation was supplemented by six weeks' work of S. S. Gannett; and 145 miles of levels were run by W. R. Atkinson. During 1889-90 the entire western half of the state (2,477 square miles) was mapped by parties in charge of J. H. Jennings, E. W. F. Natter, E. B. Clark, W. R. Atkinson, and M. B. Lambert; four topographic parties were at work during the official year 1890-91, under J. H. Jennings, W. R. Atkinson, F. P. Gulliver, and E. B. Clark. G. L. Johnson and G. E. Hyde had charge of parties for short periods. By December, 1890, all the state had been surveyed, with the exception of the Norwich sheet, which was completed in 1891.* The engraving of the maps began when the result of the field work was tabulated, and by the close of 1893 all the plates for the 33 sheets into which the Connecticut Topographic Atlas is divided, were engraved.

The printing and distribution of the maps was provided for by the following resolution, approved March 23d, 1893:—

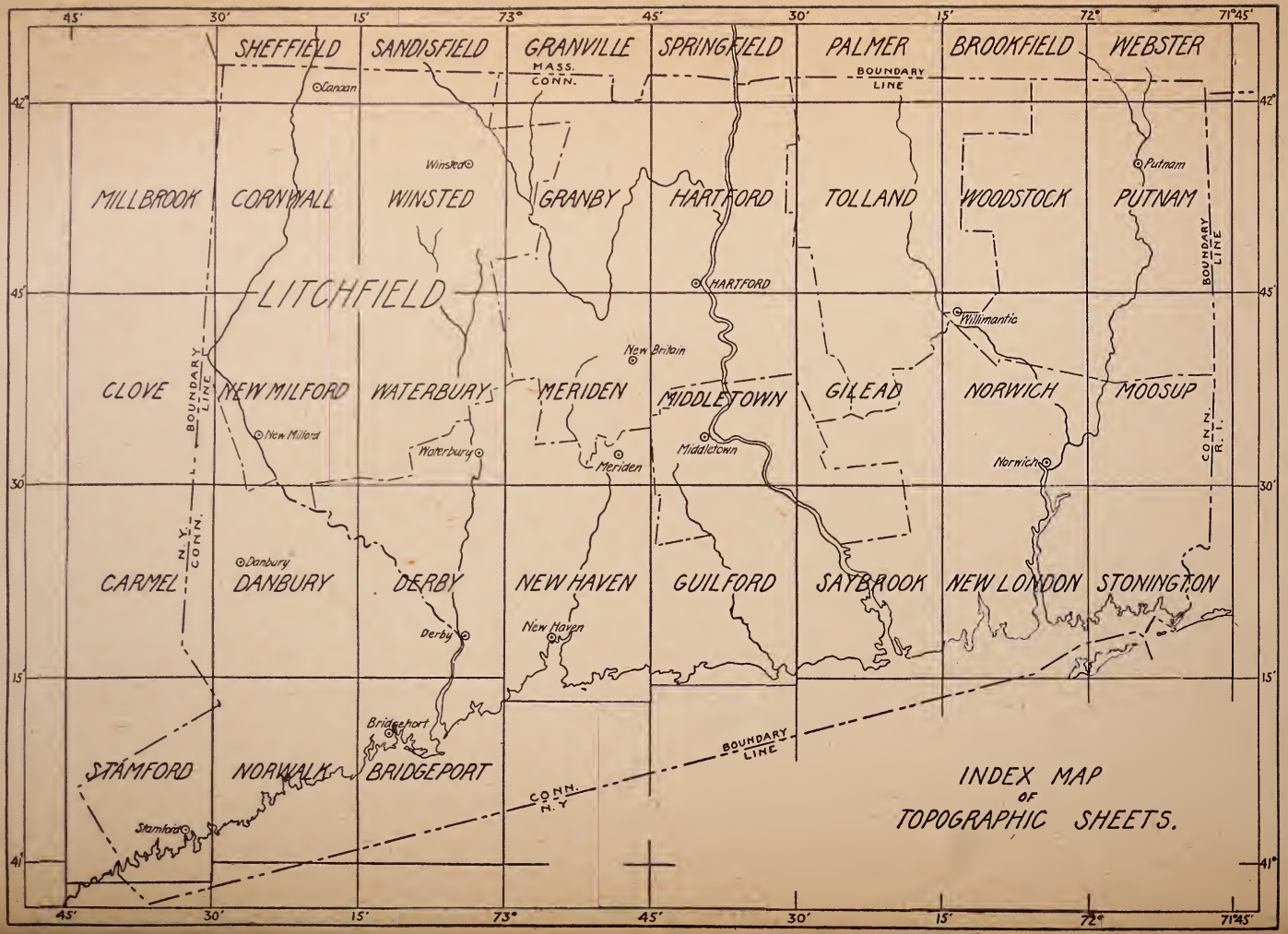
"That the sum of $5,000.00† be appropriated for the printing and distribution of the atlas sheets and maps of the State of Connecticut, under the direction of the Commissioners of the State Topographical Survey. The distribution and sale of said atlas sheets and maps shall be in charge of the State Librarian, in accordance with such prices and regulations as may be prescribed by said commissioners."‡

The commissioners arranged for the printing of 2,000 sets of separate atlas sheets, on a scale of 1:62,500 (approximately one mile to the inch), and also 1,000 copies of a wall map, on a scale of 1:125,000 (approximately two miles to the inch). Seventeen atlas sheets are entirely within the state, while seventeen others include parts of

*The area of Connecticut, exclusive of the waters of Long Island Sound and of bays more than 1,000 ft. in width, was determined to be 5,047 square miles. Later measurements make the area 4,965 square miles, of which 4,820 square miles are land surface and 145 square miles water surface. (See U. S. Geol. Surv. Bull., 302, 1906.

†The amount expended was approximately $3,400.

‡The Topographic Map is for sale by the State Librarian. Single sheets may be had for 10 cents each, postpaid, and the set of 33 sheets bound or unbound for $3.00 net. The Topographic Map of the entire state on the scale of two miles to the inch, mounted on rollers and muslin-lined, costs $1.00 net.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SHEFFIELD
SANDISFIELD
GRANVILLE
SPRINGFIELD
PALMER
BROOKFIELD
WEBSTER
MASS.
CONN.
BOUNDARY LINE
Lanoan
Winsted
Putnam
MILLBROOK
CORNWALL
WINSTED
GRANBY
HARTFORD
TOLLAND
WOODSTOCK
PUTNAM
LITCHFIELD
HARTFORD
Willimantic
New Britain
CLOVE
NEW MILFORD
WATERBURY
MERIDEN
MIDDLETOWN
GILEAD
NORWICH
MOOSUP
New Milford
Waterbury
Meriden
Middletown
Norwich
N.Y.
CONN.
Danbury
CARMEL
DANBURY
DERBY
NEW HAVEN
GUILFORD
SAYBROOK
NEW LONDON
STONINGTON
Derby
New Haven
Bridgeport
STAMFORD
NORWALK
BRIDGEPORT
Stamford
CONN.
N.Y.
INDEX MAP
OF
TOPOGRAPHIC SHEETS.

adjoining states. The location and areal extent of the sheets comprising the Connecticut Topographical Atlas are shown on the accompanying map.*

Geological and Natural History Survey of 1903.— The State of Connecticut undertook no geological work from 1842 to 1903. However, during the intervening time much work had been carried on, chiefly by Professor J. D. Dana, and by officers of the United States Geological Survey; and of late years the need of some systematic examination of the resources of the state became more and more apparent to teachers, scientific workers, and men of affairs. A proposition to organize a State Survey was informally discussed during 1901-1902; but the first definite step looking to its establishment was the presentation of a bill in the January session, 1903, of the General Assembly, prepared by the Hartford Scientific Society. The following substitute for the original bill was approved June 3, 1903:—

"Be it enacted by the Senate and House of Representatives in General Assembly convened:

"Section 1. There is hereby established a state geological and natural history survey, which shall be under the direction of a commission composed of the governor, the president of Yale University, the president of Wesleyan University, the president of Trinity College, and the president of the Connecticut Agricultural College, or so many of them as shall accept said office, who shall serve without compensation, but shall be reimbursed for actual expenses incurred in the performance of their official duties; and the said commissioners shall have general charge of the survey, and shall appoint as superintendent of the same a scientist of established reputation, and such assistants and employes as they may deem necessary; and they shall also determine the compensation of all persons employed by the survey and may remove them at pleasure.

*As originally issued, the western boundary of the Cornwall sheet was coincident with the state line. Maps published since 1902 show parts of Sharon and Kent, on the Millbrook (New York) sheet. There has recently been issued a map (The Litchfield Sheet) on a scale of two miles to the inch, including the area of the Cornwall, Winsted, New Milford, and Waterbury sheets.

"Sec. 2. Said survey shall have for its objects:

"(1) An examination of the geological formation of the state, with special reference to its economic products, to wit, building stones, clays, ores, and other mineral substances.

"(2) An examination of the animal and plant life of the state, with special reference to its economic and educational value.

"(3) The preparation of special maps to illustrate the resources of the state.

"(4) The preparation of special reports, with necessary illustrations and maps, which shall embrace both a general and detailed description of the geology and natural history of the state.

"Sec. 3. The said commissioners shall cause to be prepared a report to the general assembly before each meeting of the same, showing the progress and condition of the survey, together with such other information as they may deem necessary and useful or as the general assembly may require.

"Sec. 4. The regular and special reports of the survey, with proper illustrations and maps, shall be prepared for publication, and when printed the reports shall be distributed or sold by the commissioners as the interests of the state and of science demand, and all moneys obtained by the sale of the reports shall be paid into the state treasury.

"Sec. 5. All material collected, after having served the purposes of the survey, shall be distributed by the commissioners to the educational institutions of the state in such manner as to be of the greatest advantage to the educational interests of the state, or, if deemed advisable by said commissioners, the whole or any part of such material shall be put on permanent exhibition.

"Sec. 6. The sum of three thousand dollars, or so much thereof as may be necessary, is hereby appropriated out of any money in the treasury not otherwise appropriated, for the purpose of carrying out the provisions of this act."

The first meeting of the Commissioners was held June

15, 1903, and at the meeting of June 25, 1903, Professor William North Rice of Wesleyan University was appointed superintendent. The plan of organization and the work undertaken are explained in Bulletin No. 1.

WORK OF THE UNITED STATES GEOLOGICAL SURVEY IN CONNECTICUT.*

The United States Geological Survey was established March 3, 1879; and by an act of August 7, 1882, its authority was extended over the entire area of the United States. The first recorded work done within Connecticut was an examination of feldspar quarries by F. W. Clarke, in September, 1884.

In the year 1885-86 Raphael Pumpelly was given charge of Archæan Geology of the Eastern United States, and Professor W. M. Davis, one of his assistants, studied the sandstones and traps of the Connecticut Valley, and a paper entitled "The Structure of the Triassic Formation of the Connecticut Valley," by Professor Davis, appears in the Annual Report for this year.

1887-88. W. M. Davis continued his study of the Triassic eruptives.

1889-90. J. S. Newberry finished his work on the fossil plants of the Connecticut Triassic. W. M. Davis began detailed mapping of the Triassic rocks. In this work he was assisted by E. O. Hovey, J. A. Merrill, H. L. Rich, and S. W. Loper, the last named assistant paying particular attention to the fossiliferous black shales.

1890-91. Davis continued his work on the Triassic, and was assisted by E. O. Hovey in the New Haven region, by J. A. Merrill in the Meriden region, by H. L. Rich in the Woodbury-Southbury district, and by S. W. Loper. The glacial geology of Connecticut was in charge of Professor N. S. Shaler, and certain topographic sheets were mapped in a preliminary way by his assistants, R. E. Dodge, M. A. Read, J. B. Woodworth, and E. T. Brewster.

1891-92. The work on the Triassic was continued by

*For an account of the topographic work in Connecticut done jointly by the U. S. Geological Survey and the State of Connecticut, see page 16.

W. M. Davis, and the following assistants:— H. B. Kümmel, who studied the geology of the Hartford and Granby topographic sheets; W. N. Rice, who examined the area covered by the Middletown sheet; S. W. Loper, who continued his investigation of the black shales; and L. S. Griswold, who made a special examination of the Triassic boundaries and of districts of complicated faulting. Under the direction of Professor Shaler, the surface geology of five sheets in Connecticut was mapped by R. E. Dodge, L. H. Davis, C. R. Eastman, E. T. Brewster, and J. H. Ropes. As an extension of work done in Massachusetts, Professor B. K. Emerson, assisted by Fred A. Peck, began areal mapping on the Granby and Tolland topographic sheets.

1892-93. W. M. Davis, assisted by L. S. Griswold, W. N. Rice, and others, completed field work on the Triassic formation. Professor Shaler reported that the glacial geology of the following sheets had been mapped:— New Milford, New Haven, Derby, Danbury, Winsted, New London, Tolland, Woodstock, Norwich, Gilead, Waterbury, Cornwall.

1893-94. Under the direction of Professor Shaler, R. E. Dodge completed a glacial map of the Moosup, Putnam, and Stamford sheets, and L. H. Davis surveyed the Bridgeport and Norwalk sheets.

1895-96. During this year the work on the Hoosac Mountain region, which was begun in 1885, was extended southward, and Professor W. H. Hobbs began an areal map of the Cornwall topographic sheet.

1896-97. W. H. Hobbs completed a map of the Cornwall sheet, and made a reconnaissance of the New Milford sheet. Davis's paper on the "Triassic Formation of Connecticut" appeared in the Annual Report of this year.

1899-1900. W. H. Hobbs, assisted by H. H. Robinson, was engaged in areal work on the Danbury, Derby, Winsted, New Milford, and Waterbury sheets. A detailed study was also made of the Triassic area of the Pomperaug Valley. In the Annual Report for this year appears "The Newark System of the Pomperaug Valley, Connecticut," by William

Herbert Hobbs. Herbert E. Gregory began work on the crystalline rocks of the Granby and Meriden sheets.

1900-1901. Two hundred square miles of the Danbury, Derby, Norwalk, and Bridgeport sheets were mapped by Professor W. H. Hobbs. A paper on "The Old Tungsten Mine at Trumbull, Connecticut," by William H. Hobbs, appears in the Annual Report for this year. Herbert E. Gregory, in conjunction with L. G. Westgate, completed a survey of the crystalline rocks of the Hartford and Middletown sheets, and made a reconnaissance of the Tolland sheet.

1901-1902. C. R. Van Hise, assisted by W. H. Smith, made a general study of the stratigraphy of western Connecticut. W. H. Hobbs, assisted by S. H. Ball and A. F. Smith, was at work on the Danbury, Derby, Norwalk, and Bridgeport sheets, and completed the areal mapping of Connecticut west of the 73d meridian. Herbert E. Gregory, assisted by C. H. Warren and W. E. Ford, Jr., made a preliminary map of the Tolland, Woodstock, Putnam, Gilead, Norwich, and Moosup sheets.

1902-1903. Herbert E. Gregory completed the areal work previously begun on the Granby and Meriden sheets. W. E. Ford, Jr., assistant, made a study of the granite-gneiss in the vicinity of Stony Creek.

1903-1904. Professor Hobbs made a study of the iron ore deposits on the Cornwall, New Milford, Winsted, and Waterbury sheets. Herbert E. Gregory, assisted by G. F. Loughlin and C. J. Sarle, mapped the Glacial deposits of the Granby, Meriden, Hartford, and Middletown sheets. Professor Gregory also collected well and spring records, and began the study of the underground waters of the state. The results of this work appear in Water Supply and Irrigation Papers, Nos. 102 and 114. In this year a systematic study of the streams of the state was begun by N. C. Grover. Gaging stations had been previously established on the Housatonic River (1900), and on the Byram and Mianus (1902).

1904-1905. A gaging station was established on the Shetucket River near Willimantic, and a study of the

Thames River drainage basin was begun. Other rivers examined are the Connecticut and the Housatonic. Mr. E. E. Ellis, under the general direction of Herbert E. Gregory, made a study of the occurrence of water in the crystalline rocks of the state.

As the result of recent work, the following manuscripts have been prepared by officers of the United States Geological Survey, and submitted for publication:—

The Litchfield Folio (including the Cornwall, Winsted, New Milford, and Waterbury topographic sheets), containing geologic maps and descriptive text; by William Herbert Hobbs.

The Farmington Folio (including the Granby, Hartford, Meriden, and Middletown sheets), containing maps and text; by Herbert E. Gregory.

The Underground Waters of Connecticut; by Herbert E. Gregory and E. E. Ellis.

WORK OF THE BUREAU OF SOILS.

The first Report of Field Operations of the Division of Soils (now Bureau of Soils) of the United States Department of Agriculture, was for the year 1899, and contains an account of a soil survey made in the Connecticut Valley by Clarence W. Dorsey and J. A. Bonsteel. The area mapped and described is located on the Hartford and Springfield topographic sheets. In 1903 soil mapping was continued to include practically all of the Triassic north of a line through Berlin.

WORK OF PRIVATE INDIVIDUALS.

In addition to the officers of state and national surveys, many private individuals have made contributions to the geology of Connecticut. Foremost among these geologists are Benjamin Silliman and James D. Dana.

In the Transactions of the Connecticut Academy of Arts and Sciences, Vol. I (1810), there appeared an article by Benjamin Silliman, entitled, "Sketch of the Mineralogy of the Town of New Haven." This paper was followed by

others dealing with the trap rock of New Haven, Hartford, Talcott Mountain, and Woodbury, and by articles descriptive of minerals and fossils. In his paper on the "Igneous Origin of some Trap Rocks,"* Professor Silliman discusses contact metamorphism and the volcanic nature of the basalt near Hartford, and suggests some of the principles whose application by Davis served to discriminate the contemporaneous from the intrusive traps.

James D. Dana began his contributions to Connecticut geology in 1843 by a discussion of the trap rocks. Many papers followed, dealing with the sandstones, the igneous rocks, and the glacial deposits of the Connecticut Valley and of New Haven. Perhaps the most valuable contribution made by Professor Dana to the geology of his adopted state was a study of the limestone, quartzite, and schists of the New York-Connecticut border. The structure of this region is involved, and the discussion concerning the age and structural relations of the rocks constituted the "Taconic Question" which occupies so large a space in the geologic literature of New England and New York. The mistaken field observations of Emmons, reinforced by *ex cathedra* discussions by Hunt and Marcou, tended to confuse an already difficult problem. Dana, aided later by Walcott and Merrill, settled the Taconic question by determining the structure and age of the Berkshire schist and of the Stockbridge limestone.

W. W. Mather has to his credit the first extensive piece of detailed areal mapping of the crystalline rocks. His "Sketch of the Geology and Mineralogy of New London and Windham County," accompanied by a colored geologic map, appeared in 1834. In 1875, E. S. Dana prepared a paper on the Trap Rocks of the Connecticut Valley, which was the first important memoir on petrography published in this country.

Before his connection with the United States Geological Survey, Professor W. M. Davis published papers in which the structural relations and origin of the Triassic traps were

* *Am. Journal of Science*, series 1, vol. XVII, pp. 119-132.

clearly defined. A paper by Professor W. N. Rice on the Trap and Sandstone in the Gorge of the Farmington River at Tariffville, published in 1886, was an important aid in determining the extrusive origin of certain trap rocks.

Papers dealing with the paleontology of Connecticut have been issued by E. Hitchcock, J. D. Dana, Marsh, Newberry, Lull, and others.

THE GEOLOGICAL MAP OF 1907.

The geological map herewith presented was prepared by Herbert E. Gregory and H. H. Robinson, at the request of the Superintendent of the Geological and Natural History Survey.

Geographic Base.— The base map used for the representation of the geologic features is the topographic map of 1893. For recording facts in the field the large scale atlas sheets were used. The data thus indicated were transferred by the authors to the small scale (2 m.=1 in.) State map, and this map was still further reduced by the engraver to the scale of the present map (4 m.=1 in.).

Geologic Maps Used in Compilation.— In the preparation of the geologic map, the manuscript maps and published maps of the following geologists have been used:—

William Herbert Hobbs: A manuscript map of Connecticut west of the 73d Meridian, with the exception of the area around Stamford. This map is the result of work for the United States Geological Survey (see pp. 24-26), which it is expected will appear as the Litchfield Folio and the Fairfield Folio. The authors of the present map have departed from the manuscript map of Hobbs in a few instances, particularly as to the extent of the Danbury granodiorite-gneiss.

William Morris Davis: Map of the Triassic Area of Connecticut, United States Geological Survey, 18th Ann. Rep., Pl. II. This map, of which the original manuscript copy was supplied by Professor Davis, has been used in its entirety, except where modified by the work of Herbert E. Gregory on the Farmington Folio.

Herbert Ernest Gregory: A manuscript map of Connecticut east of the 73d Meridian, with the exception of an area

in the vicinity of Middletown and of the shore line from New Haven to Mystic. This map is the result of work under the auspices of the United States Geological Survey (1899-1900, 1900-1901, 1901-1902), and of the Connecticut Geological and Natural History Survey (1904-05).

Henry Hollister Robinson: Manuscript map of the sheets bordering Long Island Sound from Lighthouse Point to Mystic; based on work done under the auspices of the Connecticut Geological and Natural History Survey.

Lewis Gardner Westgate: A manuscript map of the crystalline rocks of the southeast corner of the Middletown sheet.

James Gates Percival: In a number of localities where the work of the field parties did not join, or where the facts could not be determined without further field work, the map of the Percival Survey of 1842 was followed.

Scope of the Map.— Only bed-rock formations have been represented on the map. The cover of till, stratified drift, lacustrine deposits, etc., has been entirely omitted. Moreover, many areas of easily recognized rock have been omitted from the map on account of their small size. This applies to the smaller areas of amphibolite, to pegmatite, quartz veins, soapstone, serpentine, etc. An exception has been made in favor of the diabase dikes in the crystallines.

Geologic Boundaries.— The drawing of accurate geologic boundaries is in many cases made impossible by two facts: the mantle of drift, which in many places covers all contacts; and the evident gradation between adjoining formations. More detailed work will doubtless result in determining more precisely the extent of certain formations, but in some cases the boundaries will probably never be located with assurance.

Nomenclature.— The names applied to the formations are those used by the various field parties, and indicate areas of rock of like composition and structure. The equivalence of a formation within the state with one outside has not been

assumed, except where the authors are personally familiar with both areas.

Aid from the United States Geological Survey.— The present map has been made possible by the kindness of the United States Geological Survey, and the authors wish to express their thanks for permission to use freely the unpublished material of Messrs. Hobbs and Gregory.

Value of the Map.— The authors wish it distinctly understood that the map of 1907 is not in any sense a final or complete map. The material at hand in published reports and unpublished notes and manuscript maps has been utilized, but with little effort to reconcile divergent views of various workers, and no attempt at correlation. The most reliable parts of the map are those based on work done by the United States Geological Survey.* The map of 1907 is not designed especially to furnish new material for scientific experts, but aims to bring together the scattered geologic data which have been accumulating since the publication of Percival's map in 1842. It is hoped that the publication of even an incomplete map will be found acceptable to the people of the state.

Explanation of Base Map and Color Scheme.— The data for the geographic base of the Connecticut geologic map of 1907 were taken from the United States Geological Survey topographic map of the state, first published in 1893, on a scale of 1:125,000. The principal difference lies in the omission of a large number of names, small streams, and some of the roads. The roads are indicated by fine black lines; water is blue; topography is shown by contour lines with a vertical interval of 100 feet, and is in brown. A small circle within a town indicates the location of the village or city which has the same name as the town. The round black dots on the railroads locate stations, and these were put on from the time-tables (January, 1906) published by the railroads. Location of quarries (granite, sandstone, marble, etc.) is shown by black crossed hammers.

* See page 23.

The color scheme adopted for the map was devised with reference only to the geology of Connecticut. Of the thirty-eight formations (excluding the Triassic) shown on the map, the geologic age of only four has been assigned. These four known formations are all in the Western Crystallines, occupying about one-third of that area, so that the entire mass of the Eastern Crystallines is of unknown age. It did not seem advisable, therefore, to follow any conventional color scheme for bringing out age distinctions; and, instead, an attempt has been made to make a distinction between the several principal groups of formations petrologically considered.

SUMMARY OF GEOLOGICAL FORMATIONS.

For convenience in using the accompanying geological map, the following brief statement is given of the important features of the different formations. More complete descriptions are to be found in Bulletin No. 6.

1. Poughquag Quartzite.— The formation consists of two types: the massive granular, composed largely of quartz and feldspar; and the schistose, in which a considerable amount of mica is present. Origin, sedimentary. Age, Cambrian.

2. Stockbridge Limestone.— A light gray to white marble of medium grain; composed largely of calcite. At some localities it becomes dolomitic, passing into a true dolomite. Origin, sedimentary. Age, Cambro-Ordovician.

3. Berkshire Schist.— Is generally a gray or greenish gray muscovite-biotite schist, with rusty foliation planes, and usually closely folded. Porphyritic minerals developed in the rock are usually feldspar and garnet; but staurolite, biotite, and tourmaline also occur. Origin, sedimentary. Age, Upper Ordovician.

4. Becket Gneiss.— It is light gray in color, of firm texture, and has a uniform banded structure. In many places the rock is highly quartzose and granular. Included within the formation are many veins of quartz and pegmatite. Supposed to be of pre-Cambrian age.

5. Hartland Schist.— Rock is everywhere a mica schist of definable character, but exhibits great variation in texture, composition, and field appearance. Its aspect has been rendered still more complicated by intrusions of igneous rock on a large scale. Origin, sedimentary.

6. Waterbury Gneiss.— It is believed that this gneiss was originally Hartland schist, and that granitic intrusions

and quartzose veins have penetrated it to such an extent that its original appearance is largely concealed.

7. Milford Chlorite Schist.— For the most part an evenly foliated, greenish colored schist. Quartz is an important constituent in seams, lenses, and veins. Small bands of serpentine occur in the schist. Was originally a diabase or similar igneous rock.

8. Orange Phyllite.— This rock is a slate or phyllite, highly fissile, sericitic, and usually dotted with minute garnets. Toward the west it is more micaceous, in places approaching a mica schist; and is also frequently feldspathic. Quartz veins occur frequently, and lenses of quartz are almost universally found in the formation. Believed to have been originally a shale, more or less calcareous.

9. Prospect Porphyritic Gneiss.— Is light gray in color. The gneissoid appearance is produced by bands of granular quartz and feldspar interbedded with layers composed chiefly of biotite. The porphyritic mineral is usually orthoclase, white or pink in color, and varying from one-sixteenth inch to three inches in length. The rock is believed to have been a granite porphyry intruded into the Hartland schist.

10. Bristol Granite-gneiss.— Typical rock is light gray, with gneissoid structure more or less developed by the presence of layers of biotite; more schistose layers have muscovite. An evenly banded hornblende gneiss occupies part of the area. Garnet is nearly always present, and at places rises to the rank of a principal mineral. The rock was originally a mass of granite and diorite intruded into Hartland schist.

11. Collinsville Granite-gneiss.— Two types appear intermingled without order — a light gray, heavy-bedded rock, grading into massive granite; and a very dark gray to black variety, which grades by imperceptible stages into evenly banded hornblende gneiss. The rock consists of feldspar, largely orthoclase, quartz in irregular grains, and biotite. Was originally granite and diorite intruded into Hartland schist.

12. Brookfield Diorite.— Is usually massive, but shows

also gneissoid and even schistose phases. Both light and dark types are present, the former containing much quartz, and in extreme cases no dark mineral except biotite. The dark variety shows an almost complete absence of quartz, and in its place dark hornblende. It is an igneous mass intruded into the quartzite and schists of this region.

13. Danbury Granodiorite-gneiss.— The rock presents two important facies — a biotite granite, and a diorite in which hornblende becomes an important constituent and quartz is less prominent. There are gradations between the two types. It is prevailingly porphyritic, with pink or white phenocrysts of feldspar. Is igneous in origin, and was intruded prior to the time when metamorphic action converted igneous and sedimentary rocks alike into gneisses and schists.

14. Thomaston Granite-gneiss.— Rock varies in structure from an almost massive granite to a rock with distinctly schistose phases. It is of igneous origin, as shown by the fact that it often occurs as dikes, and fragments of other rocks are included in it.

15. Glastonbury Granite-gneiss.— Two types: a granitic biotite gneiss or a biotite granite, in a narrow band along the eastern border; and a darker, well foliated gneiss, with biotite, hornblende, and epidote, in the remainder of the area. Both massive and schistose phases sometimes become augen-gneiss. Believed to be of igneous origin.

16. Bolton Schist.— Is a silvery sericite schist, showing considerable variation in character, and includes gneissoid bands, as well as beds of quartzite and marble. Besides feldspar, quartz, muscovite, and sericite, the rock contains garnet, biotite, and staurolite in abundance. Origin, sedimentary.

17. Monson Granite-gneiss.— Where typically exposed, the rock is a fine-grained, dark gray, uniform biotite-hornblende gneiss, marked at short intervals by parallel seams of quartz, and with bands of biotite and hornblende. It is believed to be of igneous origin.

18. Brimfield Schist. — The typical rock is rusty, dark or purplish in color, showing great variation in the develop-

ment of schistosity. Feldspar, quartz, biotite, and garnet are the common constituents, with sillimanite and graphite in small amounts. Origin, sedimentary.

19. Eastford Granite-gneiss.— In general, a light or dark gray gneiss, fine-grained, or in places even porphyritic. The composition and texture show the rock to be of igneous origin.

20. Woodstock Quartz Schist.— It varies in character from an almost pure quartzite to a mica schist with abundant quartz grains. Origin, sedimentary.

21. Pomfret Phyllite.— Where typically developed, it is well foliated, the foliation planes being made of minute flakes of mica, which give the rock a purplish tone and silky luster. Origin, sedimentary.

22. Putnam Gneiss.— The formation is extremely variable in texture, and sometimes in composition. It consists of bands of schist, gneiss, quartzite, and igneous intrusions in great variety. In texture the rock varies from a compact, bluish black slate and quartzite, through fine black schist, to coarse, gray, quartzose schist and feldspathic gneiss. In composition the formation shows gradations from a hornblende-biotite schist, with little or no feldspar, through a quartz-biotite schist and gneiss, to a quartzite. Origin, sedimentary.

23. Plainfield Quartz Schist.— See Woodstock Quartz Schist, No. 20.

24. Sterling Granite-gneiss.— The rock is pink or gray in tone, and is made up of two distinct types: a porphyritic gneiss, with an abundance of biotite along foliation planes; and an aplite, or granite-gneiss practically free from mica. The porphyritic type is always highly gneissoid, and the phenocrysts of pink feldspar are drawn out into lenticular forms. Where phenocrysts are absent the rock shades into a normal granite, which is intermediate between the two above mentioned types. The aplitic type is probably a later intrusion than the porphyritic and normal types. Origin, igneous.

25. Willimantic Gneiss.— In general, the rock is coarse-grained, and often porphyritic in structure, usually consider-

ably crumpled and folded. There are two varieties, the light and the dark. The light variety consists of quartz, feldspar, and biotite, in the proportions of a normal granite. The dark variety contains a relatively smaller amount of feldspar and quartz, with a larger amount of biotite and some hornblende. Origin, igneous.

26. Hebron Gneiss.— Where typically developed, the rock is a fine-grained, finely foliated gneiss, with usually a relatively small amount of feldspar. As a whole, however, it has much variety of character, not only in the nature of its minerals but in their arrangement as well. It varies from granitic gneiss to highly fissile schist, and it is only when the entire area is considered that the term gneiss seems appropriate. Believed to be of sedimentary origin.

27. Scotland Schist.— It is a coarse muscovite schist. The rock practically consists of muscovite with some biotite, and occasionally garnet and quartz. The quartz generally occurs as seams and lenses an inch or less in width. Origin, sedimentary.

28. Canterbury Granite-gneiss.— The formation consists essentially of a muscovite-biotite gneiss, varying in texture from a fine, even-grained rock, to a porphyry with feldspars a quarter of an inch or so in length. Metamorphism has produced irregular wavy bands of biotite separated by flattened layers of quartz and feldspar. Origin, igneous.

29. Middletown Gneiss.— This formation is not a unit. Where least injected with amphibolite and granite, it is a fine-grained, light gray to greenish, thin-bedded gneiss. In many places its composition is very complex. Is presumably the contact zone between the Haddam Granite-gneiss and the surrounding formations.

30. Maromas Granite-gneiss.— It is in some places massive, but usually well foliated. Composition is that of a normal granite. (See Sterling Granite-gneiss, No. 24.) This rock is eruptive, and intruded into the Bolton schist.

31. Haddam Granite-gneiss.— It is a light colored, rather fine-grained, granitic aggregate of quartz and feldspar, through which are scattered small isolated flakes of

biotite. In the outcrops the rock is a moderately thick-bedded gneiss. Origin, igneous.

32. Branford Granite-gneiss.—The rock is a medium-grained granite with a banded structure, consisting very largely of white feldspar. In the feldspars are imbedded small round quartz grains, and biotite is also present in about equal amount. Small reddish garnets commonly occur, but may fail entirely. The rock has a pronounced tendency to weather, with a brownish stain on the cleavage surfaces of the feldspar. Origin, igneous.

33. Stony Creek Granite-gneiss.— See Sterling Granite-gneiss, No. 24.

34. Lyme Granite-gneiss.— See Sterling Granite-gneiss, No. 24.

35. New London Granite-gneiss.— See Sterling Granite-gneiss, No. 24.

36. Mamacoke Gneiss.— The rocks occupying the larger areas of this formation are decidedly gneissic, sometimes containing much biotite, and more rarely hornblende, and are frequently very granitic in appearance. The typical rock is uniformly medium-grained, light to dark gray in color, and consists of white feldspar and quartz, with brilliant black mica, and sometimes small amounts of hornblende and garnet. The dark minerals constitute about one-third of the rock, but the range in both directions is considerable; in one case giving rise to a biotite gneiss, in the other a granitic one. Origin, igneous.

37. Preston Gabbro-diorite.— A dark colored rock, massive, in places porphyritic, ranging in composition from gabbro, through normal diorite to quartz diorite. A deep-seated igneous mass exposed to view by erosion.

38. Amphibolite.— In nearly all cases it has a distinct gneissoid structure, and is composed in large part of porphyritic feldspar and green hornblende, with a subordinate amount of quartz.

39. See 42.

40. Sandstone.— Sedimentary rock of Triassic age, including shales, sandstones, conglomerates.

41. Basalt.— Dark colored "trap" rock of Triassic age, occurring as lava flows interbedded with sandstones.

42. Diabase.— Dark colored "trap" rock, occurring as dikes and sheets intruded into sandstone and crystalline rock. Probably all of Triassic age.

ADVERTISEMENT.

List of Bulletins of the State Geological and Natural History Survey of Connecticut.

1. First Biennial Report of the Commissioners of the State Geological and Natural History Survey, 1903-1904.

2. A Preliminary Report on the Protozoa of the Fresh Waters of Connecticut; by Herbert William Conn.

3. A Preliminary Report on the Hymeniales of Connecticut; by Edward Albert White.

4. The Clays and Clay Industries of Connecticut; by Gerald Francis Loughlin.

5. The Ustilagineæ, or Smuts, of Connecticut; by George Perkins Clinton.

6. Manual of the Geology of Connecticut; by William North Rice and Herbert Ernest Gregory. (In press.)

7. Preliminary Geological Map of Connecticut; by Herbert Ernest Gregory and Henry Hollister Robinson. (In press.)

8. Bibliography of Connecticut Geology; by Herbert Ernest Gregory. (In press.)

9. Second Biennial Report of the Commissioners of the State Geological and Natural History Survey, 1905-1906.

Bulletins 1 and 9 are merely administrative reports, containing no scientific matter. The other bulletins may be classified as follows: —

Geology; Bulletins 4, 6, 7, 8.

Botany; Bulletins 3, 5.

Zoölogy; Bulletin 2.

These bulletins are sold and otherwise distributed by the State Librarian. The prices are as follows: No. 1, $0.05; No. 2, .35; No. 3, .40; No. 4, .30; No. 5, .15; No. 6, .50; No. 7, .60*; No. 9, .05.

It is intended to follow a liberal policy in gratuitously distributing these publications to public libraries, colleges, scientific institutions, and to scientific men, teachers, and others who require particular bulletins for their work, especially to those who are citizens of Connecticut.

Applications or inquiries should be addressed to

GEORGE S. GODARD,
State Librarian,
Hartford, Conn.

*If map is printed on thick paper, and sent in a mailing-tube, $0.75; if map is mounted as a wall map, and sent by express, $1.60.

CATALOGUE SLIPS.

Connecticut. *State geological and natural history survey.*

Bulletin no. 7. Preliminary geological map of Connecticut. By H. E. Gregory and H. H. Robinson. Hartford, 1907.

39 pp., 2 maps (1 in pocket), 23cm.

Gregory, Herbert Ernest, and ***Robinson, Henry Hollister.***

Preliminary geological map of Connecticut. By Herbert Ernest Gregory and Henry Hollister Robinson. Hartford, 1907.

39 pp., 2 maps (1 in pocket), 23cm.

(Bulletin no. 7. Connecticut geological and natural history survey.)

CATALOGUE SLIPS.

Robinson, Henry Hollister, and ***Gregory, Herbert Ernest.***

Preliminary geological map of Connecticut. By Herbert Ernest Gregory and Henry Hollister Robinson. Hartford, 1907.

39 pp., 2 maps (1 in pocket), 23^{cm}.

(Bulletin no. 7, Connecticut geological and natural history survey.)

Geology.

Gregory, H. E., and Robinson, H. H. Preliminary geological map of Connecticut. Hartford, 1907.

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Gregory, Herbert E. 1869-
1952.

Preliminary geological map
of Connecticut

LEGEND

MESOZOIC
TRIASSIC

40 Sandstone & Shale

Basalt · Diabase · 40a Diabase (dikes)

PALEOZOIC AND ARCHEAN
METAMORPHIC SEDIMENTARY

4 Stockbridge Limestone (Cambro-Ordovician)

1 Poughquag Quartzite (Cambrian) · 20 Woodstock Quartz Schist · 23 Plainfield Quartz Schist

6 Prospect Phyllite · 24 Pomfret Phyllite

SCHISTS

3 Berkshire (Ordovician) · 5 Hartland

16 Bolton · 18 Brimfield

27 Scotland

GNEISSES OF COMPLEX ORIGIN

4 Bedford (Pre-Cambrian) · 5 Waterbury

32 Putnam · 26 Hebron

36 Manchester · 25 Willimantic

29 Middletown

METAMORPHIC IGNEOUS

GRANITE-GNEISSES

9 Prospect · 10 Bristol

12 Collinsville · 14 Thomaston

24 Sterling · 34 Lyme
33 Stony Creek · 35 New London

19 Eastford · 31 Haddam

Glastonbury · Monson

Canterbury · Maromas

Branford

Danbury Granite-Gneiss Gneiss

7 Milford Chloritic Schist · 17 Brookfield Diorite

37 Preston Gabbro Diorite · 38 Amphibolite

CONNECTICUT GEOLOGICAL AND NATURAL HISTORY SURVEY
WILLIAM NORTH RICE, SUPERINTENDENT

PRELIMINARY GEOLOGICAL MAP OF CONNECTICUT

BY
H.E. GREGORY & H.H. ROBINSON

Scale 1/250,000

0 1 2 3 4 5 6 7 8 9 10 miles

Contour interval 100 feet

1906

For acknowledgments of material used in this map, and for explanations additional to those given in the legend, see Bulletin No. 7 of Connecticut Geological and Natural History Survey